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STRUCTURAL, STRATIGRAPHIC AND METAMORPHIC
GEOLOGY OF LOWER PROTEROZOIC ROCKS
IN THE COWELL/CLEVE DISTRICT,
EASTERN EYRE PENINSULA.

VOLUME I

by

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SUMMARY

The structural and petrological development of (?) Lower Proterozoic rocks during the Middle Proterozoic Olarian orogeny has been studied in detail within a small area between Cowell and Cleve on Eyre Peninsula. Several major fold deformations have been recognized and the resolution of their macroscopic effects has enabled a specific stratigraphic succession to be reconstructed. That succession has been highly metamorphosed and intruded by various granitic bodies and a detailed analysis of the microstructure has identified several specific events and related them to the deformational evolution. Preliminary geochronology has put some constraints on the timing of those events during the Olarian orogeny.

Four principal periods of deformation are identified. The first of these, D_1 , was a high grade fabric forming deformation. It does not appear to have been a major fold deformation but because of a lack of suitable data a definite conclusion could not be reached. The second deformation, D_2 , was a major fold deformation that produced macroscopic folds of isoclinal style with pervasive, high grade axial fabrics (L - S). It affected the entire study area and produced inclined or recumbent folds. D_3 , the third major deformation, in contrast to D_2 , produced macroscopic upright folds of tight but not isoclinal style. Axial fabrics were only weakly developed, but there was considerable variation in strain and two highly strained zones with strong D_3 fabrics have been delineated. Mylonites are developed in one of these and the progressive development of slaty mylonite from an incipient D_3 fabric is described. D_3 quartz textures and crystallographic

fabrics also vary throughout the area and their progressive development is also discussed. The final major period of ductile deformation, D_4 , produced mesoscopic folds and crenulations but did not contribute greatly to the macroscopic geometry. Crenulations of pre-existing fabrics were developed during each of the D_2 , D_3 and D_4 deformations but each set has its own characteristics which when considered together outline steps in the development of crenulation cleavages and schistositities.

The stratigraphy defined by the resolution of macroscopic D_2 and D_3 folds consists principally of a basal calcsilicate/quartzite unit overlain by a sequence of dolomites, iron formations, amphibolites and semipelitic and pelitic gneisses. The whole sequence is assigned to the Hutchison Group but the quartzite unit and the succession of rocks containing the iron formations have been compared with the Warrow Quartzite of southern Eyre Peninsula, and the Middleback Group of the Middleback Ranges respectively. The stratigraphy defined in this study can be closely correlated with sequences throughout Eyre Peninsula and indeed is similar to sequences of similar age throughout the world. This is discussed along with brief discussions on the nature of the basement to the Hutchison Group, the origin of the amphibolites, the presence of two iron formations and the structural implications of the stratigraphy.

The metamorphic evolution of the region can be considered as a single major cycle with pulses of recrystallisation promoted by deformation. The main phase (s) of metamorphism, M_{1-2} , was associated with the D_1 and D_2 deformations. It was a high grade, low to medium pressure event of upper amphibolite

facies, that locally produced migmatites. Two separate phases of M_{1-2} have been recognized in some areas and it is suggested that M_1 was the main event with M_2 only slightly modifying it. Subsequent phases of metamorphism, M_3 and M_4 , were of retrogressive nature and did not greatly alter the M_{1-2} assemblages except in zones of intense strain such as the mylonite zone. They were associated with the D_3 and D_4 deformations respectively and were of upper greenschist facies.

Three major granitic bodies, all previously referred to as the Flinders Group, have been identified. The Plug Range granite gneiss is believed to be basement to the Hutchison Group, the Middle Camp granite was intruded just prior to or during D_2 , and the Narridy Creek granite was intruded during D_3 . Hence only the first is considered to belong to the Flinders Group proper.

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